

REMARKS/ARGUMENTS

Applicants wish to thank the Examiner for the careful review of the claims, specification and drawings.

Claims

Claims 1-34, 37, 40, and 43 have been canceled.

Independent claims 35 and 45 have been amended.

Dependent claims 36 and 46-50 have been amended.

After entry of this amendment, claims 35, 36, 38, 39, 41, 42, and 44-50 are pending.

It is respectfully submitted that each and every feature recited in the pending claims are fully supported in the specification as filed. No new subject matter has been added.

Rejections under 35 USC § 112

The Office Action rejected claims 35-36, 38-39, 41-42 and 44-50 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The Office Actions argues that the previous amendments to claims 35-36, 45, and 50 are new matter. The Office Action further argues that claims 36 and 50 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Applicants hereby amend independent claims 35 and 45, as follows:

35. (Currently amended) A method for ~~selecting~~ determining an endpoint indicator in plasma processing, the method comprising:
- providing ~~at least a first RF~~ a signal having a ~~first fundamental frequency and a second RF signal having a second fundamental frequency~~;
 - etching, in a plasma processing chamber, at least one sample substrate using the ~~first RF signal and the second RF signal~~;
 - determining at least one calibrating endpoint by performing an empirical analysis on the at least one sample substrate;

etching, in the plasma processing chamber, at least one test substrate using ~~the first RF signal and the second RF~~ one or more signals having the frequency, the at least one test substrate being etched for at least one time duration beyond the at least one calibrating endpoint;

measuring a plurality of parameters over at least one time range when etching the at least one test substrate, the at least one time range including the at least one calibrating endpoint, at least a start point of the at least one time range is delayed relative to at least a start point of the at least one time duration;

comparing data pertaining to at least a ~~first plurality of harmonics for the plurality of parameters and a second plurality of harmonics for the plurality of parameters~~, the ~~first plurality of harmonics representing frequency harmonics of said first fundamental frequency and the second plurality of harmonics representing harmonics of the second fundamental frequency~~, the data pertaining to at least sensitivity of the ~~first plurality of harmonics for the plurality of parameters and the second plurality of harmonics for the plurality of parameters~~ responsive to the at least one calibrating endpoint; and

selecting the endpoint indicator based on the comparing, the endpoint indicator including a selected harmonic ~~for a selected one of the first fundamental frequency and the second fundamental frequency~~ for a select parameter of said plurality of parameters.

45. (Currently Amended) A method for detecting an endpoint in plasma processing that employs a ~~plurality of RF signals having a plurality fundamental frequencies~~ frequency, the method comprising:

etching a at least one sample substrate using ~~the plurality of RF signals~~ at least one signal having the frequency;

determining a calibrating endpoint by performing an empirical analysis on ~~an~~ at least one etched location of the at least one sample substrate;

etching at least one test substrate using ~~the plurality of RF signals~~ one or more signals having the frequency, the at least one test substrate being etched for at least one time duration beyond the calibrating endpoint;

measuring a plurality of parameters over a time range when processing the at least one test substrate, the time range including the calibrating endpoint;

comparing data pertaining to a plurality of harmonics of the frequency plurality of
~~fundamental frequencies~~ for the plurality of parameters, the data pertaining to the calibrating
endpoint;

selecting a ~~given~~ harmonic of a ~~given fundamental~~ the frequency for a ~~given~~
parameter from the plurality of harmonics of the frequency plurality of fundamental
~~frequencies~~ for the plurality of parameters as an endpoint indicator based on the comparing,
wherein a signal representing the harmonic of the ~~given fundamental~~ frequency for the ~~given~~
parameter is selected from a plurality of signals representing the plurality of harmonics of the
frequency plurality of fundamental frequencies for the plurality of parameters as ~~being the~~
~~signal with~~ having the most ~~discernible~~ repeatable response pertaining to ~~said the~~ calibrating
end point;

setting at least one criterion pertaining to the ~~given~~ harmonic of the ~~given~~
~~fundamental~~ frequency for the ~~given~~ parameter for indicating the endpoint;

etching a production substrate at the ~~given~~ frequency;

determining a time window around an expected endpoint, the expected endpoint
determined based on the calibrating endpoint, the time window being less than the at least
one time duration;

monitoring the ~~given~~ harmonic of the ~~given fundamental~~ frequency for the ~~given~~
parameter within the time window when etching the production substrate; and
signaling the endpoint when the at least one criterion is met.

Support for the amendments to claims 35 and 45 may be found, for example, in one or
more of paragraphs [0028] and [0032] in this application. The amendments to claim 45 may
also be found, for example, in paragraph [0031] in this application. It is respectfully
submitted that the amended claims 35 and 45 and associated dependent claims 36, 38-39, 41-
42 44, and 46-50 do not contain new subject matter.

Applicants also amend dependent claims 36 and 50, as follows:

36. (Currently amended) The method of claim 35 wherein the at least one time range is
~~predefined and is less than a time duration required to etch the test substrate~~ ends earlier than

the at least one time duration and forms a time window around an expected endpoint, the expected endpoint determined based on the at least one calibrating endpoint.

50. (Currently amended) The method of claim 45 wherein ~~the time range is predefined and is less than a time duration required to etch the at least one test substrate~~ monitoring is not performed before the time window.

The amendments to claims 36 and 50 may be found, for example, in one of more of paragraphs [0028] and [0032] in this application. It is respectfully submitted that the amended claims 36 and 50 do not contain new subject matter. It is also respectfully submitted that each of the amended claims 36 and 50 is definite to particularly point out and distinctly claim the subject matter which Applicants regard as the invention

Rejections under 35 USC § 102

The Office Action rejected claims 35-36, 39, 41, 44-48, and 50 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Turner et al. (US 5576629), hereinafter "Turner".

The Office Action rejected claims 35-36, 39, 41-42 and 44-50 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Butler et al. (US 5458732), hereinafter "Butler".

The Office Action rejected claims 35-36, 39, 41, 44-48 and 50 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Miyashita et al. (JP 08227875), hereinafter "Miyashita".

Independent claim 35 has been amended to include the limitation/feature that at least a start point of the at least one time range (for measuring the plurality of parameters) is delayed relative to at least a start point of the at least one time duration (for etching the at least one substrate). Support for the amendment may be found, for example, in one or more of paragraphs [0028] and [0032] in this application.

In contrast, none of Turner, Butler, and Miyashita teaches a start point of a time range for measuring a plurality of parameters that is delayed relative to a start point of a time duration for etching a substrate.

Independent claim 45 has been amended to include the limitation/step of determining a time window around an expected endpoint, the expected endpoint determined based on the calibrating endpoint, the time window being less than the at least one time duration. Independent claim 45 has also been amended such that the monitoring is performed within the time window. Independent claim 45 has also been amended to include the limitation/feature that the endpoint indicator represents a signal that has the most repeatable response pertaining to the calibrating end point. Support for the amendment may be found, for example, in one or more of paragraphs [0028], [0031], and [0032] in this application.

In contrast, none of Turner, Butler, and Miyashita teaches such a time window. None of Turner, Butler, and Miyashita teaches selecting an endpoint indicator based on repeatability. Turner mentioned repeatability of the endpoint signal (e.g., Col. 18, Ln. 12-19), but does not teach selecting a signal that has the most repeatable response pertaining to a calibrating end point as the endpoint indicator.

For the aforementioned reasons and others, it is respectfully submitted that the amended claims 35 and 45 are novel, non-obvious, and patentable over the cited arts of records, taken alone or in combination.

Claim 36 has been amended to include the limitation/feature that the at least one time range (for measuring the plurality of parameters) ends earlier than the at least one time duration (for etching the at least one substrate) and forms a time window around an expected endpoint, the expected endpoint determined based on the at least one calibrating endpoint. Support for the amendment may be found, for example, in one or more of paragraphs [0028] and [0032] in this application.

Claims 46-50 have been amended such that antecedent basis is provided.

Claim 50 has been further amended to include the limitation/feature that the monitoring is not performed before the time window (around an expected endpoint). Support for the amendment may be found, for example, in one or more of paragraphs [0028] and [0032] in this application.

It is respectfully submitted that claims 36, 39, 41, 44, 46-48, and 50 which depend from at least one of the amended claims 35 and 45 also are novel, nonobvious, and patentable not only due to their recitations of independently patentable features but also due to their dependence from at least one of the patentable parent claims 35 and 45.

Rejections under 35 USC § 103

The Office Action rejected claims 38 under 35 U.S.C. 103(a) as being unpatentable over Turner in view of Kagoshima et al. (US Pub 2003/0003607), hereinafter "Kagoshima".

The Office Action rejected claims 42 and 49 under 35 U.S.C. 103(a) as being unpatentable over Turner in view of Butler.

It is respectfully submitted that claims 38, 42, and 49 which depend from at least one of the amended claims 35 and 45 also are novel, nonobvious, and patentable not only due to their recitations of independently patentable features but also due to their dependence from at least one of the patentable parent claims 35 and 45.

CONCLUSION

In view of the discussion herein, Applicant(s) believe that all pending claims are allowable and respectfully request a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at 408-213-9540.

If any additional petition is required to facilitate the entry of the present amendment, please consider this communication a petition therefore as well. The Commissioner is authorized to charge any fees beyond the amount enclosed which may be required, or to credit any overpayment, to Deposit Account No. 50-2284 (Order No. LMRX-P037).

Respectfully submitted,
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